

CHANDRAYAAN - 1 : A FACT FILE

In its fourteenth flight conducted from Satish Dhawan Space Centre (SDSC), SHAR, Sriharikota on the morning of 22 October 2008, the Indian Space Research Organisation's (ISROs) Polar Satellite Launch Vehicle, PSLV-C11, successfully launched the 1380 Kg Chandrayaan-1 spacecraft into a transfer orbit with a perigee (nearest point to Earth) of 255 km and an apogee (farthest point to Earth) of 22,860 km, inclined at an angle of 17.9 deg to the equator.

After a 52 hour count down, PSLV-C11 lifted-off from the Second Launch Pad at the SDSC, SHAR at 06:22 Hrs Indian Standard Time (IST) with the ignition of the core first stage. The important flight events included the separation of the first stage, ignition of the second stage, separation of the payload fairing at about 116 km altitude after the vehicle had cleared the dense atmosphere, second stage separation, third stage ignition, third stage separation, fourth stage ignition and fourth stage cut-off.



PSLV-C11 is the uprated version of ISROs Polar Satellite Launch Vehicle in its standard configuration. Weighing 320 tonnes at lift-off, the vehicle uses larger strap-on motors (PSOM-XL) to achieve higher payload capability. PSOM-XL uses 12 tonnes of solid propellants instead of 9 tonnes used in the earlier configuration of PSLV. PSLV is a four stage launch vehicle employing both solid and liquid propulsion stages. PSLV is the trusted workhorse launch Vehicle of ISRO. During 1993-2008 period, PSLV had fourteen launches of which thirteen (including this launch) are consecutively successful. PSLV has repeatedly proved its reliability and versatility by launching 30 spacecraft (14 Indian and 16 for international customers) into a variety of orbits so far.

Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram, designed and developed PSLV. ISRO Inertial Systems Unit (IISU) at Thiruvananthapuram developed the inertial systems. The Liquid Propulsion Systems Centre (LPSC), also at Thiruvananthapuram, developed the liquid propulsion stages for the second and fourth stages of PSLV as well as reaction control systems. SDSC, SHAR processed the solid propellant motors and carried out launch operations. ISRO Telemetry, Tracking and Command Network (ISTRAC) provided telemetry, tracking and command support.

Chandrayaan-1 is India's first spacecraft mission beyond Earth's orbit. It aims to further expand our knowledge about Earth's only natural satellite - the moon. With well-defined objectives, Chandrayaan-1 mission intends to put an unmanned spacecraft into an orbit around the moon and to perform remote sensing of our nearest celestial neighbour for about two years using eleven scientific instruments built in India and five other countries.

The Payloads: There are 11 payloads (scientific instruments) through which Chandrayaan-1 intends to achieve its scientific objectives. They include five instruments designed and developed in India, three instruments from European Space Agency (one of which is developed jointly with India and the other with Indian contribution), one from Bulgaria and two from the United States.

The Indian payloads of Chandrayaan-1 are:

Terrain Mapping Camera (TMC), a CCD camera that maps the topography of the moon, which helps in better understanding of the lunar evolution process.

Hyperspectral Imager (HySI), another CCD camera is designed for mapping of the minerals on the lunar surface as well as for understanding the mineralogical composition of Moons interior.

Lunar Laser Ranging Instrument (LLRI) provides necessary data for accurately determining the height of lunar surface features.

High Energy X-ray Spectrometer (HEX) is designed to help explore the possibility of identifying Polar Regions covered by thick water-ice deposits as well as in identifying regions of high Uranium and Thorium concentrations.

Moon Impact Probe (MIP) demonstrates the technologies required for landing a probe at the desired location on the moon. It is also intended to qualify some of the technologies related to future soft landing missions.

The six international payloads of Chandrayaan-1 are:

Chandrayaan-1 Imaging X ray Spectrometer (CIXS), an ESA payload and jointly developed by Rutherford Appleton Laboratory of England and ISRO Satellite Centre, Bangalore, intends is to carry out high quality mapping of the moon using X-ray fluorescence technique for finding the presnce of Magnesium, Aluminium, Silicon, Iron and Titanium distributed over the surface of the Moon.

Smart Near Infrared Spectrometer (SIR-2), another ESA payload, developed by Max Plank Institute of Germany, aims to study the lunar surface to explore the mineral resources and the formation of its surface features.

Sub kiloelectronvolt Atom Reflecting Analyser (SAR), the third payload from ESA, is built by Swedish Institute of Space Physics and Space Physics Laboratory of Vikram

Sarabhai Space Centre, Tiruvananthapuram. The aim of this instrument is to study the surface composition of the moon and the magnetic anomalies associated with the surface of the moon.

Radiation Dose Monitor (RADOM), a payload developed by Bulgarian Academy of Sciences, aims to characterise the radiation environment in a region of space surrounding the moon.

Mini Synthetic Aperture Radar (MiniSAR) is one of the two scientific instruments from the USA and is from Johns Hopkins Universitys Applied Physics Laboratory and Naval Air Warfare Centre, USA through NASA. MiniSAR is mainly intended for detecting water ice in the permanently shadowed regions of the lunar poles up to a depth of a few meters.

Moon Mineralogy Mapper (M3) is an imaging spectrometer from Brown University and Jet Propulsion Laboratory of the US through NASA, is intended to assess and map lunar mineral resources at high spatial and spectral resolution.

The Spacecraft : Chandrayaan-1 spacecraft weighed about 1380 kg at the time of its launch and is a 1.5 m cuboid with a solar panel projecting from one of its sides. The spacecraft is powered by a single solar panel generating electrical power of 700 W. A Lithium ion battery supplies power when the solar panel is not illuminated by the sun. To make Chandrayaan-1 spacecraft to travel towards the Moon, its Liquid Apogee Motor (LAM) is used. Liquid propellants needed for LAM as well as thrusters are stored onboard the spacecraft. Chandrayaan-1 spacecrafts Dual Gimballed Antenna transmits the scientific data gathered by its eleven scientific instruments to Earth.